Introduction to Full Spectrum LOCA Concept

December 13, 2005

LTR-NRC-05-68 NP-Attachment

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Meeting Objectives

Introduce NRC to Westinghouse Next Generation LOCA Technology

- Drivers for Full Spectrum LOCA (FSLOCA)
- PIRT development process
- Code selection and improvements
- Validation matrix
- Uncertainty methodology
- Schedule

Obtain Informal Initial Feedback, as Appropriate

Current Westinghouse Technology

Large Break LOCA

- Best-estimate methods based on WCOBRA/TRAC (PD2) well established
  - ASTRUM (2004), CQD (1996)
    - Valid from 1 ft^2 to DEG (2 * 4.12 ft^2)
    - Marviken assessments down to 0.76 ft^2

Small Break LOCA

- Appendix K methods based on NOTRUMP (1985), S2M (1997)
  - Typical NOTRUMP applications to 8 in only (0.35 ft^2)

Intermediate Break LOCA

- Not routinely analyzed, historically considered non-limiting
  - Conclusion supported by recent LB Redefinition studies

Drivers for Enhanced LOCA Margins

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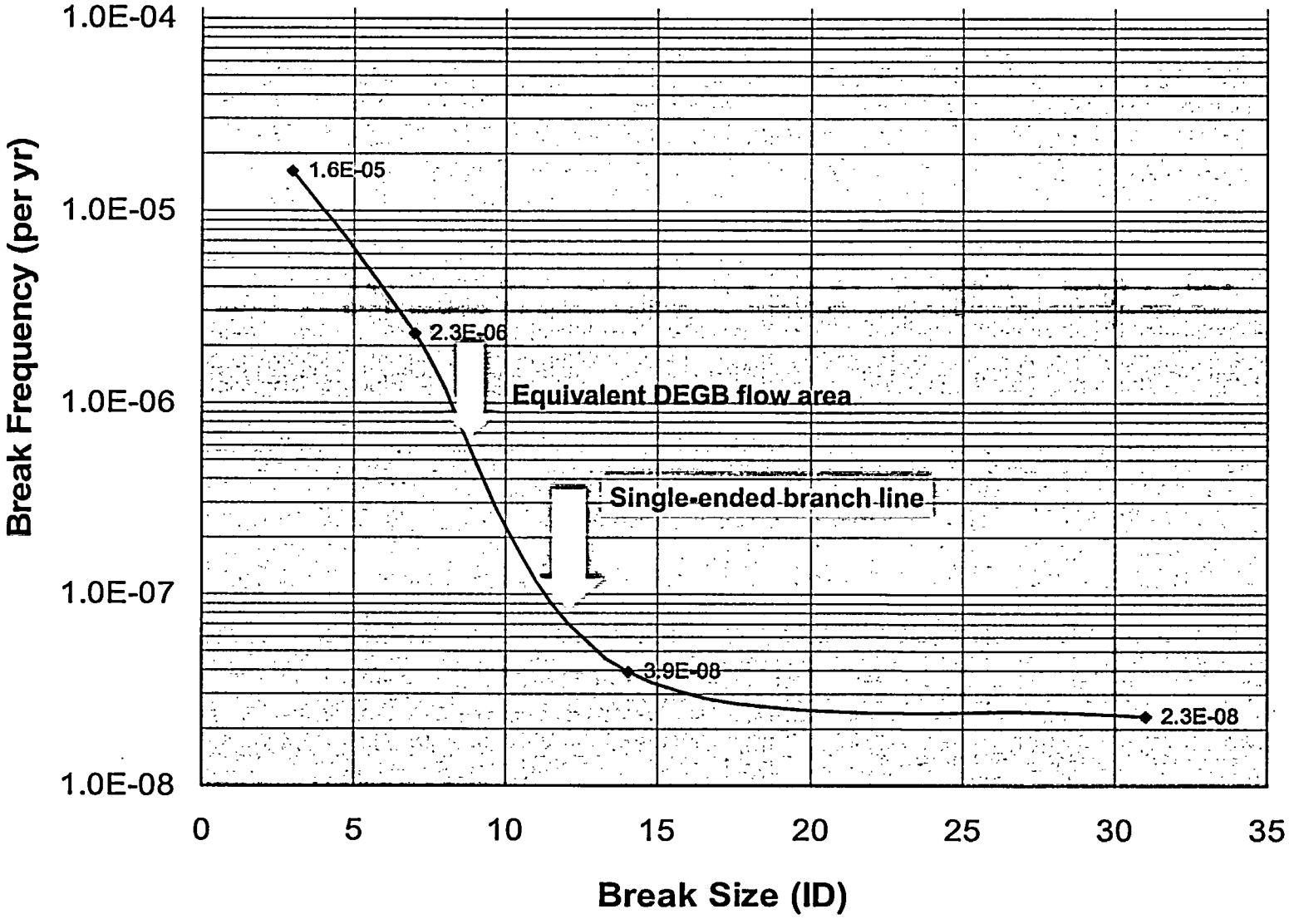
Large Break Redefinition

Rulemaking to Revise 50.46 Issued for Public Comment

- Revises maximum design basis accident to be largest connecting pipe ("transition break size", TBS)
- Current requirements remain up to TBS
- More realistic analyses allowed beyond TBS
  - No single failure, realistic power peaking, etc.
- Review of initial licensing applications expected to include more focus on IB LOCA (~ TBS) than previous experience

PWR Mean Break Frequency



Created from information in SECY 04-0060 Table 3 Current Day Estimates

Objectives for Full Spectrum LOCA - 1

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- Improve or range models as needed based on code assessment results
- Use ASTRUM-style uncertainty analysis (or better)

Objectives for Full Spectrum LOCA - 2

Minimize Current/Future Regulatory Challenges

- Eliminate SBLOCA as a margin concern

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PIRT Development Process

Scenario Identification and Partitioning, Figures of Merit

- Definition of Intermediate Break LOCA (IBLOCA)
- Applicability of FSLOCA PIRT

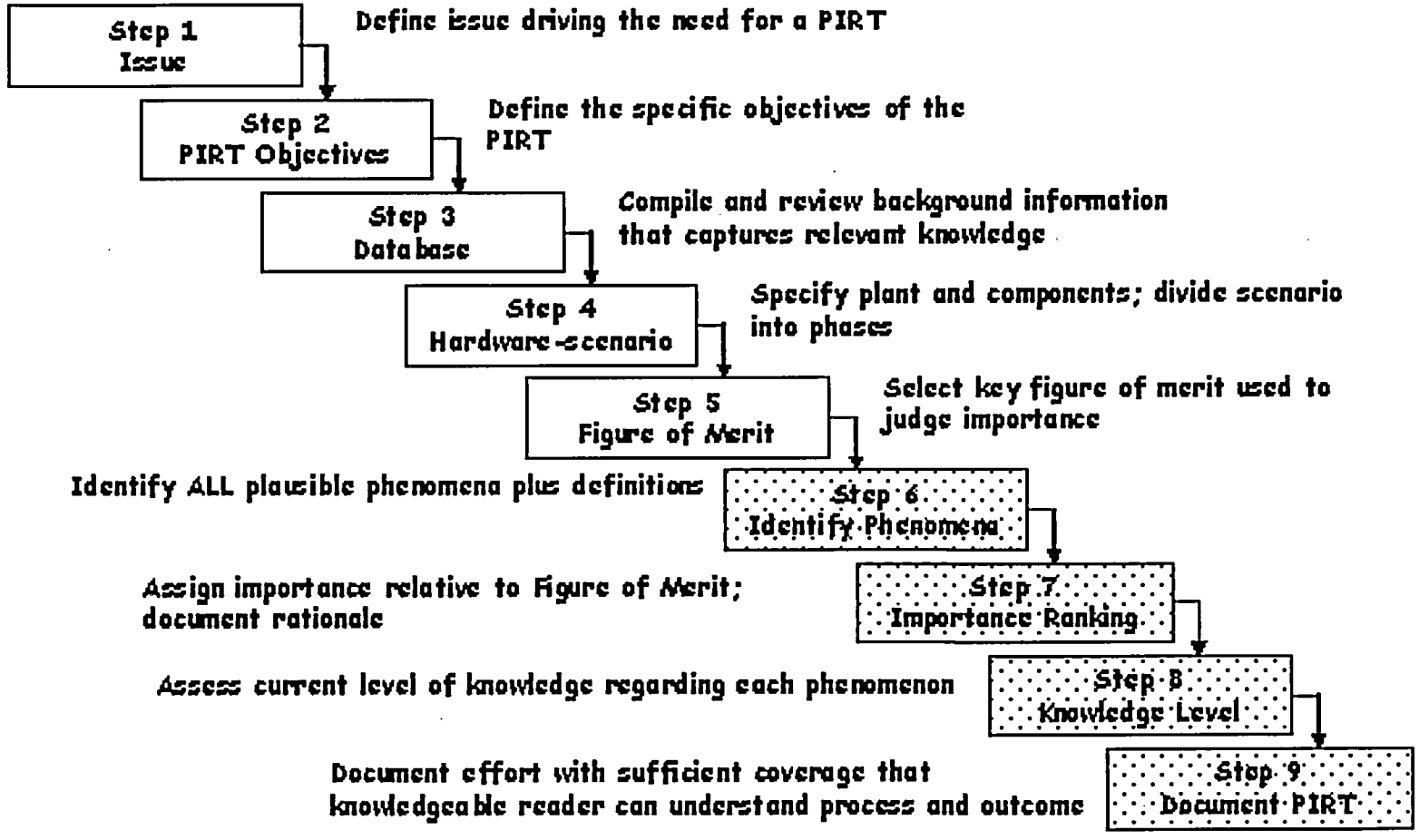
Prior Phenomena Identification Processes

- Westinghouse Large Break LOCA (LBLOCA) PIRT
- Westinghouse peer-reviewed Small Break LOCA (SBLOCA) PIRT (WCAP-14936)

Ranking Rationale

- Low, Medium and High (rather than numerical)

FSLOCA PIRT Overview



Boyack – Wilson, BE2004

FSLOCA PIRT Development Approach

FSLOCA PIRT Development based on LBLOCA and SBLOCA PIRTs

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FSLOCA PIRT – Scenario Identification and Partition

FSLOCA Scenario

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FSLOCA PIRT Divided in Three Main Parts

- Small break (SB)
- Intermediate break (IB)
- Large break (LB)

SB Scenario Partitioning

Divided into Five Time Periods

- Blowdown
- Natural Circulation
- Loop Seal Clearing
- Boil-off
- Recovery

Consistent with Previously Submitted BE SB Methodology

IB Scenario Partitioning

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LB Scenario Partitioning

Divided into Three Time Periods

- Blowdown
- Refill
- Reflood

Consistent with Currently Licensed Methodologies

Phenomena Identification

Phenomena Identification

- All phenomena from previous LB and SB PIRTs included
- Consolidation of SB and LB phenomena
  - Elimination of redundant items
  - Terminology clarification (e.g., heat transfer)
  - Consistent application of Low, Medium & High rankings
- Assessment of IB LOCAs and additional plausible phenomena

Phenomena Ranking

Ranking

- SB and LB LOCA used as a starting point
- Development of IB LOCA ranking and review of SB and LB rankings
  - Justification of all differences in LB and SB documented (e. g., terminology)

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Code Selection

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Code Improvements

Carry-over of Previous BE SB Improvements for Vessel

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- Additional ranging capability on selected models

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- Selected code improvements based on validation results
- Selected ranging capability based on PIRT and validation results

Validation - Separate Effects Tests

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Validation - Integral Effects Tests

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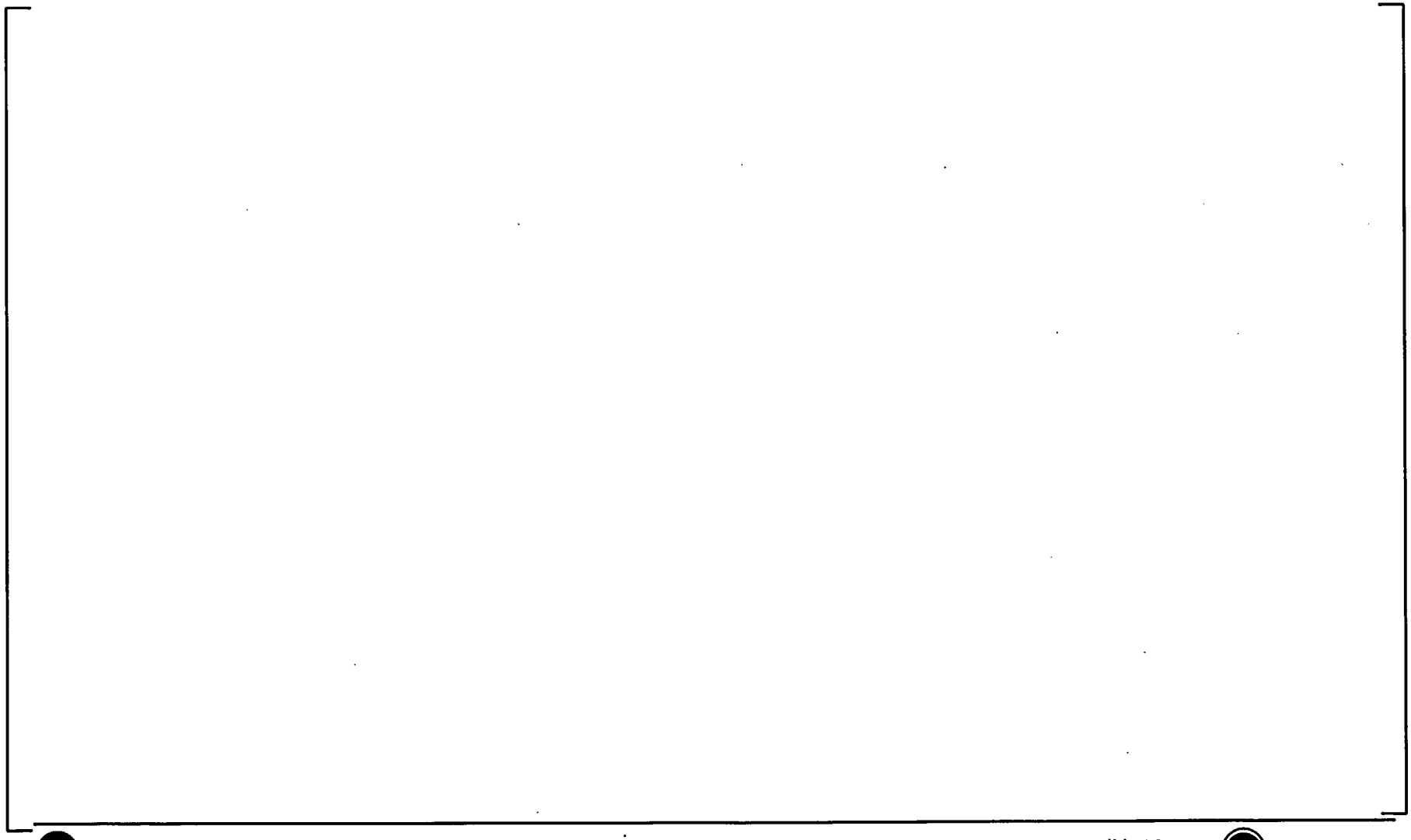

Uncertainty Methodology Considerations

Uncertainty Methodology

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Ranging of Parameters in Uncertainty Assessment

- Driven by PIRT and validation results

Uncertainty Methodology Considerations

Break Size Sampling

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- Others . . . .

Schedule for Full Spectrum LOCA Development

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Summary

Westinghouse FSLOCA Development Addresses Industry Needs

- Regulatory changes (LB redefinition, increased scrutiny of Appendix K methods, potential for ANL/CEA negative impacts)
- US/utility strategic objectives
  - EPU reduces need for more natural gas, oil consumption
  - $/MWe increase from EPU attractive for utilities

Request That Periodic Program Updates be Continued

- Westinghouse to advise NRC of evolution of code, methods
- Any informal feedback beneficial